REMARKS

Claim Amendments

Claims 1 and 12 have been amended to include the limitation "wherein said formulation is coated on an implantable medical device;" support for that amendment can be found in paragraph 0028, lines 1-3. Claims 5-6, 8-9, and 11 were objected to as being improper multiple dependent claims. Claims 5-6, 8-9, and 11 as well as claim 3 have been amended to comply with MPEP 608.01(n). Claims 2-11 and 13-14 have been amended to correct obvious errors.

35 U.S.C. § 112 Rejections

The Office has rejected claim 7 under 35 U.S.C. § 112 second paragraph as being indefinite for failing to particularly point out and distinctly claim the subject matter which the applicant regards as the invention. Specifically, the Office objects to the use of kiloDaltons (kDa) to define molecular weights for the polymers. The Office states that the Applicant should report polymer molecular weights as number average molecular weight (M_n) or weight average molecular weight (M_w). The Applicants respectfully direct the Office to Table 2 wherein M_w is defined as "weight average." The use of kDa in claim 7 is supported by the M_w data of Table 5 of the present application which is reported in kDa. In addition, kiloDaltons are a unit of measure known in the art for classifying weight average and number average molecular weights.[1] Since kDa is a unit of measure known to and used by skilled artisans, it is not improper to use it in the claims. Accordingly, the Applicants request reconsideration and withdrawal of this rejection.

35 U.S.C. § 103(a) Rejections

The Office has rejected claims 1-14 under 35 U.S.C. § 103(a) as being unpatentable over U.S. Patent 6,835,759 ("Bradford"). The Applicants respectfully disagree; however, in order to expedite prosecution, claims 1 and 12 have been amended to recite wherein the formulation is coated on an implantable medical device. Bradford does not render obvious a polymer formulation for application onto an implantable medical device, nor does it motivate one skilled in the art to the do the same. Bradford teaches a polymer which would direct a skilled artisan to utilize "one or more fillers or pigments" [column 13, line 9] in the polymer formulations. Further, Bradford teaches a skilled artisan that a suitable filler includes "talc" [column 14, line 52].

[1] Armstrong, et al., Improved molecular weight analysis of streptococcal hyaluronic acid by size exclusion chromatography. Biotechnology Techniques 1995: 9 (7) Pp. 491-496. (See Abstract)

When selecting coatings for implantable medical devices, one skilled in the art must be cautious as to the selection of the components of the polymer formulation. Talc, for example, is known to cause pulmonary micro emboli and even death if administered intravenously.[2] Talc has also been shown to be a toxic carcinogenic species and is present in a high percentage of dissected ovarian tumors.[3] A skilled artisan would not prepare an implantable medical device from such an ingredient.

In addition, the teachings of Bradford direct the skilled artisan toward using pigments to enhance the color and visual effect of the polymer [column 13, lines 51-67 and column 14, lines 1-22]. One skilled in the art of coating implantable medical devices is not concerned with the visual appeal since the coating will not be seen after the device is implanted. Therefore, the use of "metal flake pigments" [column 13, lines 51-67], "inorganic color pigments" [column 14, lines 1-13], and "organic color pigments" [column 14, lines 14-22] may not be appropriate for an implantable medical device and would require extensive testing by a skilled artisan to determine their safety. More importantly, a skilled artisan attempting to prepare an implantable medical device would not seek the teachings of a reference concerned with the visual appearance of a polymer.

In sum, Bradford does not teach an implantable medical device with a polymer coating according to the present claims. Rather, Bradford teaches the use of fillers and pigments for use in the polymer formulation. Therefore a skilled artisan attempting to prepare an invention according to the present claims would not have sought Bradford's teachings. Accordingly, the Applicants request reconsideration and withdrawal of this rejection.

Additionally, the Office has rejected claims 1-14 under 35 U.S.C. § 103(a) as being unpatentable over U.S. Patent 6,162,511 ("Garnett"). As discussed above, claims 1 and 12 have been amended to include the limitation wherein said formulation is coated on an implantable medical device, which is not taught or suggested by Garnett. Garnett does not disclose a coating applicable for implantable medical devices, but rather coatings "with high pigment or filler loadings" [column 2, line 12-13]. As discussed above, the use of pigments may not be appropriate for an implantable medical device and would require extensive testing by a skilled

[2] Hollinger M.A., Pulmonary toxicity of inhaled and intravenous talc. Toxicology Letters 1990: 52 (2) Pp. 121-127. (Abstract).
[3] Cook, et al., Perneal Powder Exposure and the Risk of Ovarian Cancer. American Journal of Epidemeology 1997: 145 (5) Pp. 459-465.

artisan to determine their safety. Further, Garnett teaches the use of talc [column 4, line 1], which as discussed above may be harmful to humans.

In addition, Garnett preferably includes one or more flame retardant additives to the composition [column 5, lines 26-27], which are not needed for an implantable medical device. In fact, the use of flame retardants in coatings for implantable medical devices would require extensive testing in order to determine their safety.

In sum, Garnett teaches a polymer formulation for coating a substrate which does not include an implantable medical device. Rather, Garnett teaches the use of fillers, pigments, and flame retardants for use in the polymer formulation. In other words, a skilled artisan attempting to prepare an implantable medical device according to the present claims would not have sought Garnett's teachings. Accordingly, Applicants request reconsideration and withdrawal of this rejection.

Conclusion

For the foregoing reasons, Applicant believes all the pending claims are in condition for allowance and should be passed to issue. The Commissioner is hereby authorized to charge any additional fees which may be required under 37 C.F.R. 1.17, or credit any overpayment, to Deposit Account No. 01-2525. If the Examiner feels that a telephone conference would in any way expedite the prosecution of the application, please do not hesitate to call the undersigned at telephone (707) 543-0221.

Respectfully submitted,

/Catherine C. Maresh, Reg. No. 35,268/
Catherine C. Maresh
Registration No. 35,268
Attorney for Applicant

Medtronic Vascular, Inc.
3576 Unocal Place
Santa Rosa, CA 95403
Facsimile No.: (707) 543-5420

1: Toxicol Lett. 1990 Jul;52(2):121-7; discussion 117-9.

Pulmonary toxicity of inhaled and intravenous talc.

Hollinger MA.

Department of Pharmacology, School of Medicine, University of California, Davis 95616.

Talc (magnesium silicate) is a widely used, generally considered benign substance. It is principally used as an inert filler material in drug tablets or as a drying ingredient in baby powders. However, in both cases inappropriate use can lead to severe pulmonary toxicological responses. On the one hand, intravenous injection of 'solubilized', CNS active pills can produce microemboli in small pulmonary vessels. This can lead to various degrees of granuloma formation, compromised pulmonary function, or death. Overzealous application of baby powder can also produce severe pulmonary complications if the infant inspires the powder. Although the data are relatively scarce, a number of reports suggest the existence of a chronic problem in this area.

PMID: 2198684 [PubMed - indexed for MEDLINE]

American Journal of Epidemiology

Vol 145, No 5
Printed in U.S.A.

Perineal Powder Exposure and the Risk of Ovarian Cancer

Linda S. Cook,[1] Mary L. Kamb,[1,2] and Noel S. Weiss[1,2]

This case-control study evaluated the risk of epithelial ovarian cancer associated with genital exposure to various forms of powder application. Cases included all women aged 20–79 years in three counties of western Washington who were diagnosed with borderline or invasive ovarian cancer from 1986 through 1988; 64.3% of eligible cases were interviewed. A sample of similarly aged women who lived in these counties, identified by random digit dialing, served as controls. The overall response among control women was 68.0%. Information on powder application and other potential risk factors was ascertained during the in-person interview. Overall, ovarian cancer cases (n = 313) were more likely than controls (n = 422) to ever have used powder (age-adjusted relative risk (RR) = 1.5, 95% confidence interval (CI) 1.1–2.0). After adjustment for age and other methods of genital powder application (none vs. any), an elevated relative risk of ovarian cancer was noted only for women with a history of perineal dusting (RR = 1.6, 95% CI 1.1–2.3) or use of genital deodorant spray (RR = 1.9, 95% CI 1.1–3.1) These results offer support for the hypothesis, raised by prior epidemiologic studies, that powder exposure from perineal dusting contributes to the development of ovarian cancer, and they suggest that use of genital deodorant sprays may do so as well. Limitations of the present study include the fairly low proportion of eligible women who participated and the potential differential recall of powder usage. *Am J Epidemiol* 1997;145:459–65.

ovarian neoplasms; powders; talc

Studies documenting the migration of carbon particles and radioactive particulate agents from the vagina to the ovaries (1, 2), as well as those that have identified talc-like particles more frequently in ovarian tumors than in normal human ovarian tissue (3), have raised concern that genital powder exposure may increase a woman's risk of developing ovarian cancer. While the results of several epidemiologic studies have suggested elevated risks for ovarian cancer among women with genital powder exposures (4–11), results have been inconsistent for particular methods of powder application (12). In this population-based case-control study, information on the method, duration, and frequency of powder application was collected to evaluate the impact of genital powder exposures on the risk of epithelial ovarian cancer.

MATERIALS AND METHODS

Women with invasive or borderline epithelial ovarian cancer were identified from records of the population-based Cancer Surveillance System of western Washington. Eligible case subjects included white women diagnosed between January 1, 1986, and December 31, 1988, who resided in three counties of western Washington (King, Pierce, and Snohomish counties) and were 20–79 years of age at diagnosis. After obtaining permission from their personal physicians to contact the women and obtaining written, informed consent, we successfully interviewed 329 (64.3 percent) of the 512 eligible case subjects. The remaining 183 women were not interviewed because of death prior to study contact (n = 104, 20.3 percent), physician or subject refusal (n = 73, 14.3 percent), and lack of success in locating the women (n = 6, 1.2 percent). Seven women whose self-reported race/ethnicity was other than white and nine women with unknown genital powder use were also excluded. Thus, a total of 313 white women diagnosed with borderline (n = 79) or invasive (n = 234) epithelial ovarian tumors were available for analysis.

Women identified as control subjects for this study were part of a larger control pool selected by random digit dialing (13) for several studies of cancer in women. Of the total 10,109 calls made by random digit dialing, 5,853 (57.9 percent) were to nonresidential phone numbers, 3,830 (37.9 percent) were to residential phone numbers, and 426 (4.2 percent) were to

Received for publication May 20, 1996, and accepted for publication October 22, 1996.

Abbreviations: CI, confidence interval; RR, relative risk

[1] Fred Hutchinson Cancer Research Center, Seattle, WA.
[2] Department of Epidemiology, University of Washington, Seattle, WA.
Reprint requests to Dr. Linda S. Cook, MP-381, Fred Hutchinson Cancer Research Center, 1124 Columbia Street, Seattle, WA 98104.

numbers of unknown residential status; 3,604 (94.1 percent) of the 3,830 calls to residential households were screened for eligible women who were age matched, in 5-year age groups, to the combined female cancer case group. Of the 721 women identified who were eligible, 521 (72.3 percent) were successfully interviewed after written, informed consent was obtained. The overall response (random digit dialing screening response multiplied by the interview response) was 68.0 percent. Women who reported race/ethnicity other than white (n = 28), age greater than 79 (n = 5), a history of bilateral oophorectomy (n = 58), uncertainty concerning a history of bilateral oophorectomy (n = 4), and unknown genital powder use (n = 4) were excluded, resulting in a total of 422 white control women for analysis.

Information regarding genital powder exposures was collected by structured, in-person interviews. Women were queried about storing diaphragms in powder, dusting perineal areas with powder after bathing, powdering sanitary napkins, and using genital deodorant sprays (which may contain aerosolized powder). Those who answered affirmatively were questioned further about the duration and frequency of powder application and about the types of powder applied. Powders were grouped into five categories: cornstarch, talcum powder, baby powder, deodorant powder, and scented body/bath powder. Information on demographic characteristics, reproductive history, medical and screening histories, smoking history, anthropometry, and birth control methods was also provided by the women. A calendar was used to record major life events and enhance recall of past exposures. Relevant study information was recorded only for exposures that occurred prior to the diagnosis date of cancer among the cases or the analogous reference date among controls.

Logistic regression (EGRET version 26.6; Statistics and Epidemiology Research Corporation, Seattle, Washington) was used to determine odds ratios as estimates of the relative risk for ovarian cancer associated with genital powder application and 95 percent confidence intervals (14). For all the relative risk estimates reported in the present analysis, women who reported any method, type, or frequency of genital powder application were compared with women who stated that they had never applied genital powder in any manner (154 ovarian cancer cases and 256 controls). Trends were evaluated using the likelihood ratio statistic (14).

First, the relative risk for ovarian cancer among women who reported exclusive use of one of the four methods of powder application was assessed (table 2). Then, because many women used more than one method of powder application, the risk for ovarian cancer among women who reported any use of the four methods of powder application was assessed while adjusting for the other methods of powder application (table 3). Similarly, ovarian cancer risk by exclusive and nonexclusive use of the type(s) of powder used for perineal dusting, diaphragm storage, or on sanitary napkins was assessed (table 4). To assess the impact of genital powder exposure on the risk of specific histologic categories of ovarian tumors (table 5), we grouped borderline and invasive ovarian tumors according to the following *International Classification of Diseases for Oncology* histologic codes (15): serous tumors (codes 8441, 8442, 8460, 8461, and 8462); mucinous tumors (codes 8470, 8472, 8473, 8480, and 8481); endometrioid tumors (codes 8380, 8381, and 8560); and other tumors that included clear cell (code 8310), undifferentiated (code 8020), and unclassified/other (codes 8010, 8050, 8140, 8240, 8260, 8440, 8450, and 9000). All relative risk estimates were adjusted for age. Further adjustment for education, income, marital status, body mass index (weight (kg)/height $(m)^2$), oral contraceptive use, or parity did not alter the estimated relative risks. Information on lactation was not available. Separate analyses for women diagnosed with invasive ovarian cancer and for those diagnosed with borderline ovarian cancer produced results very similar to those presented in tables 2–5.

RESULTS

Selected characteristics of ovarian cancer cases and controls are presented in table 1. Less education, a lower household income, and a higher body mass index were more common among women with ovarian cancer than among control women, but oral contraceptive use and having had a full-term birth were less common.

Genital powder application was more common among cases (50.8 percent) than controls (39.3 percent) (table 2). There was an overall 50 percent elevation in the risk for ovarian cancer associated with the use of one or more of the four possible methods of genital powder application (95 percent CI 1.1–2.0). Among women who exclusively used a single method of powder application, ovarian cancer risk was most strongly elevated among those who dusted perineal areas with powder after bathing (RR = 1.8, 95 percent CI 1.2–2.9).

We further examined ovarian cancer risk among women who reported application of genital powders using each of the four methods, although not necessarily exclusive use of any method (table 3). Perineal dusting was associated with an increased risk of ovar-

TABLE 1. Characteristics of epithelial ovarian cancer cases and controls: King, Pierce, and Snohomish counties, Washington State, 1986–1988

Characteristic	Cases (n = 313)		Controls (n = 422)	
	No	%	No	%
Age (years)				
20–34	34	10 9	84	19.9
35–44	50	16 0	136	32 2
45–54	60	19 2	65	15 4
55–64	88	28 1	63	14 9
65–79	81	25 9	74	17.5
Education (years)				
≤8	15	4.8	14	3.3
9–12	124	39 6	144	34.1
13–16	146	46 6	219	51 9
>16	27	8 6	45	10 7
Unknown	1	0 3	0	
Annual household income ($)				
<15,000	90	28 8	83	19.7
15,000–30,000	91	29 1	153	36 3
>30,000–45,000	60	19 2	81	19 2
>45,000	63	20 1	96	22.7
Unknown/refused	9	2 9	9	2 1
Marital status				
Single	32	10.2	33	7.8
Married	186	59.4	292	69 2
Separated/divorced/widowed	95	30 4	97	23 0
Body mass index (kg/m^2)				
<21	56	17 9	97	23.0
21–22	89	28 4	145	34 4
23–24	73	23 3	75	17.8
≥25	95	30 4	105	24 9
Oral contraceptive use				
Never or ≤12 months	224	71 6	221	52.4
>12 months but <5 years	50	16 0	93	22 0
≥5 years	39	12 5	108	25.6
Total pregnancies				
0	57	18.2	56	13.3
1	42	13 4	56	13.3
≥2	214	68 4	309	73 2
Unknown	0		1	0 2
Total full-term births				
0	79	25 2	83	19.7
1	46	14.7	69	16.4
≥2	188	60.1	269	63.7
Unknown	0		1	0.2

ian cancer (RR = 1.6, 95 percent CI 1.1–2.3), although there was no clear pattern of increasing risk with increasing duration of use. When the small contribution of perineal dusting after a hysterectomy or tubal ligation was excluded from the analysis, our relative risk estimates were nearly unchanged (data not shown). In 1976, the cosmetic industry proposed voluntary guidelines to limit contamination of consumer powders (16), and we attempted to evaluate ovarian cancer risk associated with any perineal dusting in 1976 or before and with exclusive perineal dusting in 1977 or thereafter. Women with any perineal dusting in 1976 or before had an elevated risk (RR = 1.8, 95 percent CI 1.1–2.9), but we were unable to evaluate exclusive perineal dusting in 1977 and thereafter since only four cases and 10 controls had this exposure. The use of genital deodorant sprays was also associated with an elevated ovarian cancer risk (RR = 1.9, 95 percent CI 1.1–3.1), with the strongest elevation in risk among the small number of women (n = 15) who used these sprays for more than 1 year (RR = 2.7, 95 percent CI 1.1–6.6). Storing a diaphragm in powder or powdering sanitary napkins was not related to the risk of developing an ovarian tumor (RR = 1.0, 95 percent CI 0.6–1.6, and RR = 0.9, 95 percent CI 0.5–1.5, respectively).

TABLE 2. Relative risk of epithelial ovarian cancer associated with any genital powder use and by exclusive use of various methods of powder application: King, Pierce, and Snohomish counties, Washington State, 1986–1988

Powder application	Ovarian cancer cases (n = 313)		Controls (n = 422)		RR*	95% CI*
	No	%	No	%		
Lifetime genital powder application						
None	154	49.2	256	60.7	1.0	Referent
Any	159	50.8	166	39.3	1.5	1.1–2.0
Exclusive use of						
Perineal dusting only	55	17.6	48	11.4	1.8	1.2–2.9
Diaphragm storage in powder only	22	7.0	35	8.3	0.8	0.4–1.4
Powder on sanitary napkins only	12	3.8	10	2.4	1.5	0.6–3.6
Genital deodorant spray only	18	5.8	28	6.6	1.5	0.8–3.0

* RR, relative risk, adjusted for age, CI, confidence interval

No specific type of powder used for perineal dusting, diaphragm storage, or on sanitary napkins was strongly related to ovarian cancer risk, although there was a suggestion of an elevated risk associated with any use of talcum powder and bath/body powders (RR = 1.6, 95 percent CI 0.9–2.8, and RR = 1.5, 95 percent CI 0.9–2.4, respectively) (table 4). When specific histologic categories of ovarian tumors were examined, any genital powder application was associated with an elevated risk for serous tumors (RR = 1.7, 95 percent CI 1.1–2.5) and the nonspecific category of other tumors (RR = 1.8, 95 percent CI 1.1–2.8), whereas no elevation in risk was noted for the small number of women with mucinous tumors (RR = 0.7, 95 percent CI 0.4–1.4) or endometrioid tumors (RR = 1.2, 95 percent CI 0.6–2.3) (table 5).

DISCUSSION

There are several issues that should be considered in the interpretation of our results. A sizable number of women eligible for our study did not participate, particularly among those with ovarian cancer. Many women with cancer died before they could be approached about participation in this study, and others were too ill to participate. If substantial differences in powder use existed between participating and nonparticipating women, our study results may over- or underestimate the true risks for ovarian cancer. It is also possible that the completeness of the reporting of powder use differed between cases and controls, biasing our relative risk estimates to some degree.

Additionally, it is not clear how well ascertainment of perineal powder application correctly estimates actual exposure to particles in powder that may influence ovarian cancer risk. Different consumer brands of powder that women used, or even different lots of the same brand, may have varied substantially in the content of talc, asbestiform minerals, or structurally similar compounds. Powder content has also varied over time, presumably with fewer asbestiform minerals present in more recently manufactured products (17–19).

Our results suggest that a history of perineal dusting or use of genital deodorant sprays has a modest influence on the development of epithelial ovarian tumors, whereas storing a diaphragm in powder or powdering sanitary napkins does not. Direct comparisons of our results with those of the other nine published studies (and among these studies) are somewhat limited because of differences in the definitions, groupings, and analysis of genital powder use. Nonetheless, there is some consistency in results among studies. Seven studies including the present one (4, 6, 8–11) reported elevated relative risks for ovarian cancer, ranging from 1.3 to 3.9, among women with powder exposure by "dusting of the perineum." Of the three remaining studies that evaluated the more general exposure of "talc use in genital/perineal area" (which may or may not include perineal, sanitary napkin, diaphragm, or undergarment applications), two observed a modest elevation in ovarian cancer risk (5, 7), whereas one did not (20).

Most studies including the present one have found little, if any, excess risk for ovarian cancer among women who stored their diaphragms in powder (4–8, 10); only one study has reported a suggestion of an elevation in risk (11). In the present study, control women more frequently reported washing their diaphragms prior to use than did ovarian cancer cases, but ovarian cancer risk was not substantially elevated for the small number of women who did not wash their diaphragms prior to use. The relation between powdering sanitary napkins and ovarian cancer risk is less clear; three studies including the present study found

TABLE 3. Relative risk of epithelial ovarian cancer associated with genital powder use by methods of powder application: King, Pierce, and Snohomish counties, Washington State, 1986–1988*

Lifetime genital powder application	Ovarian cancer cases (n = 313)		Controls (n = 422)		RR†	95% CI†
	No	%	No	%		
None	154	49 2	256	60.7	1.0	Referent
Any perineal dusting	95	30 4	87	20 6	1.6	1.1–2 3
Cumulative lifetime days						
≤2,000	20	6 4	22	5 2	1.8	0 9–3.5
2,001–5,000	24	7 7	26	6.2	1.6	0.9–2 9
5,001–10,000	21	6.7	22	5 2	1.2	0 6–2 4
>10,000	28	8.9	17	4 0	1.8	0.9–3.4
Unknown	2	0.6	0			
Diaphragm storage in powder	46	14 7	51	12.1	1 0	0.6–1 6
Cumulative lifetime months						
≤60	24	7.7	26	6 2	1 1	0 6–1.9
>60	15	4 8	20	4.7	0 8	0.4–1 7
Unknown	7	2 2	5	1.2		
Usually washed before use						
No	19	6 1	14	3 3	1.4	0 7–3 0
Yes	20	6.4	31	7 3	0 7	0 4–1 4
Unknown	7	2 2	6	1.4		
Any powder on sanitary napkins	38	12.1	40	9.5	0 9	0.5–1 5
Cumulative lifetime months						
≤120	25	8 0	21	5.0	1 3	0 7–2.4
>120	12	3.8	19	4.5	0 5	0.2–1 1
Unknown	1	0 3	0			
Lifetime applications						
≤1,000	23	7.3	19	4 5	1.3	0.7–2 5
>1,000	14	4 5	21	5.0	0 6	0.3–1 2
Unknown	1	0.3	0			
Any genital deodorant spray	40	12.8	40	9.5	1.9	1.1–3 1
Cumulative lifetime months						
≤12	24	7.7	31	7 4	1.5	0 9–2 8
>12	15	4 8	9	2 1	2.7‡	1.1–6 6
Unknown	1	0 3	0			
Lifetime applications						
≤500	29	9.3	34	8 1	1.7	1 0–2.9
>500	10	3.2	6	1.4	2 6‡	0.9–7 6
Unknown	1	0.3	0			

* Numbers do not add up to total cases and controls because women may have used a variety of methods for powder application.

† RR, relative risk, adjusted for age and for the other methods of genital powder application (none, any), CI, confidence interval.

‡ p value for trend < 0.05.

no association (6, 10), whereas three other studies reported moderate elevations in risk (4, 8, 11).

Only two other studies have evaluated particular types of powder; one reported an excess risk of borderline ovarian tumors among women who used deodorant powders (8), and another study reported an excess risk of ovarian cancer among women who used baby powders (10). A strong relation between the types of powder used and ovarian cancer risk was not found in the present study, although there was a suggestion of an elevated risk with any use of talcum powder and bath/body powders among women using these powders for perineal dusting, diaphragm storage, or on sanitary napkins.

The present study is the first to evaluate the association between genital deodorant spray use and ovarian cancer risk; these preliminary results require confirmation in other studies. It is difficult to postulate that an increased risk for ovarian cancer may specifically be due to powder and associated constituents when some of the deodorant sprays do not contain aerosolized powder. It is possible that it is not powder per se

TABLE 4. Relative risk of epithelial ovarian cancer associated with type of powder used with perineal dusting, diaphragm storage, or sanitary napkins: King, Pierce, and Snohomish counties, Washington State, 1986–1988

Type of powder	Ovarian cancer cases (n = 313)		Controls (n = 422)		RR*	95% CI*
	No	%	No	%		
Lifetime use (none)	154	49 2	256	60.7	1.0	Referent
Exclusive use of						
Talcum powder only	16	5 1	16	3.8	1.2†	0.6–2.5
Baby powder only	31	9 9	36	8.5	1.4†	0.8–2.4
Cornstarch only	5	1 6	11	2.6	0.9†	0.3–2.9
Deodorizing powder only	9	2 9	10	2.4	1 0†	0.4–2.6
Bath/body powder only	27	8 6	25	5.9	1.6†	0.9–3 0
Unspecified type only	11	3 5	4	0.9		
Use of‡						
Any talcum powder	33	10.5	23	5 5	1.6§	0 9–2.8
Any baby powder	52	16.6	61	14.5	1.1§	0.7–1 8
Any cornstarch	8	2.6	16	3 8	0 8§	0.3–2 0
Any deodorizing powder	24	7.7	24	5 7	1.1§	0.6–2.0
Any bath/body powder	52	16 6	43	10 2	1.5§	0.9–2.4
Any unspecified type	24	7 7	11	2.6		

* RR, relative risk; CI, confidence interval.
† Adjusted for age
‡ Numbers do not add up to total cases and controls with any powder use because women may have used a variety of powders
§ Adjusted for age and the other types of powders used (yes, no).

TABLE 5. Relative risk of epithelial ovarian cancer associated with any genital powder use by tumor histology: King, Pierce, and Snohomish counties, Washington State, 1986–1988

Histologic type	Any powder application		No powder application		RR*	95% CI*
	No	%	No	%		
Controls	166	39.3	256	60.7	1 0	Referent
Serous tumors (n = 131)	71	54.2	60	45 8	1.7	1.1–2.5
Mucinous tumors (n = 43)	14	32.6	29	67.4	0.7	0.4–1.4
Endometrioid tumors (n = 36)	17	47.2	19	52.8	1.2	0.6–2 3
Other tumors† (n = 103)	57	55.3	46	44.7	1.8	1.1–2 8

* RR, relative risk, adjusted for age; CI, confidence interval
† Other tumors include 17 clear cell, three undifferentiated, and 83 unclassified (adenocarcinoma or unspecified carcinoma) tumors

but other unidentified chemical substances present in deodorant sprays that may influence the development of ovarian cancer.

A partner's use of condoms that were packed in talc could also have contributed to a woman's genital powder exposure (21). There was insufficient information in the present study to address the influence of condom use on the risk for ovarian cancer. Seven (2.2 percent) ovarian cancer cases and 19 (4.5 percent) control women reported a history of exposure to condoms packed in talc, whereas 20 (6.4 percent) cases and 34 (8.1 percent) controls did not know if their partners had used condoms packed in talc. Furthermore, few women knew or remembered the brand of condoms their partners had used.

The specific constituent(s) of powders that may influence the development of ovarian cancer is unknown, although attention has been focused on fibrous talc particles and asbestos (17–19, 22). Talc, a hydrous magnesium silicate, is a constituent of almost all body and baby powders except for those that are specifically labeled as talc free or pure cornstarch. The nonfibrous, sheet-like layers of talc in these powders slide across each other, allowing a smooth application on the skin. Talc-based powders may also contain fibrous particles, most of which are talc fibers, but some can be asbestiform fibers (17, 18). While pure talc is relatively nontoxic, adverse health effects can include induction of talc granulomas when introduced in open wounds and, in the occupational setting, pneumoconi-

osis (talcosis) in individuals with long-term exposure to talc dust (19). Occupational exposure to talc does not appear to increase the risk for pulmonary malignancies (19). Most animal studies confirm this, with lung tumors developing only in rats exposed to doses of talc dust high enough to cause chronic obstructive and restrictive lung toxicity (19). Excess ovarian tumors have not been reported in rats and mice with long-term exposure to aerosol talc (23). In contrast, occupational exposure to asbestos fibers has been shown to cause lung tumors (24) and has been associated with the development of ovarian tumors (25). Thus, while there is little biologic or experimental evidence to support a role for talc per se in the development of ovarian malignancies, the potential biologic effects of consumer powders (with their variable constituents) on the human ovary have not been well studied.

The prevalence of genital powder exposure reported among control women in this and other studies conducted in the United States ranges from 28 percent to 51 percent (4–6, 8, 10). Given such a common practice, even the modest elevation in ovarian cancer risk associated with genital powder application suggested by most of the epidemiologic studies could have a notable impact on the incidence of ovarian cancer in the United States. We recommend that cohort studies address this question; these studies could eliminate concerns regarding the potential differences in the reporting of genital powder exposures between cases and controls. We also believe that further characterization of the constituents of powder products that may influence ovarian cancer risk and the investigation of their possible biologic mechanisms of carcinogenesis are warranted.

ACKNOWLEDGMENTS

This research was supported by grant R35 CA39779 from the National Cancer Institute and by the Cancer Surveillance System of the Fred Hutchinson Cancer Research Center, which is funded by contract no. N01-CN-05230 from the Surveillance, Epidemiology, and End Results (SEER) Program of the National Cancer Institute with additional support from the Fred Hutchinson Cancer Research Center

The authors thank Kay Byron and Judy Kuskin for their programming assistance, Diana Farrow for assistance with data collection, and Robert C. Lee for his review of the manuscript and insightful comments.

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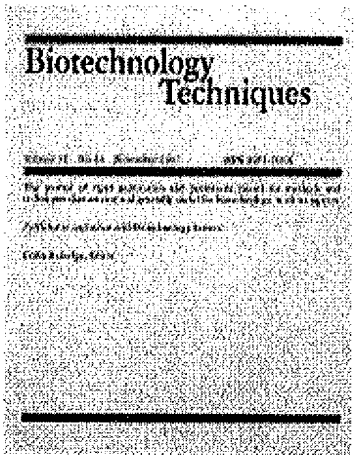

Improved molecular weight analysis of streptococcal hyaluronic acid by size exclusion chromatography

Journal	Biotechnology Techniques
Publisher	Springer Netherlands
ISSN	0951-208X (Print) 1573-6784 (Online)
Issue	Volume 9, Number 7 / July, 1995
DOI	10.1007/BF00159564
Pages	491-496
Subject Collection	Chemistry and Materials Science
SpringerLink Date	Thursday, November 04, 2004

David C. Armstrong[1] and Michael R. Johns[1]

(1) Department of Chemical Engineering, The University of Queensland, 4072 Queensland, Australia

Summary Four size exclusion chromatography (SEC) calibration techniques were tested for use in the molecular weight characterisation of Streptococcal Hyaluronic Acid (HA). An exponential equation, evaluated using the Hamielec method, was superior to the customary peak position method. It provided the most accurate estimates of the weight average molecular weight, Mw. The calibration was valid for HA in the range 800 – 2500 kDa, and permitted the calculation of both polydispersity and molecular weight distributions for HA from Streptococcal fermentations. This exponential calibration approach should have application in the characterisation of other large biopolymers, particularly where pore size of available SEC media is limiting.